SDA FOREST SERVICE
RESEARCH PAPER NC- 1 4 7

A Survey of Fishes of the McCormick Forest

RONALD A. RAISANEN AND J. KERWIN WERNER

NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE

North Central Forest Experiment Station
John H. Ohman, Director
Forest Service — U. S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication December 22, 1976

1977

ACKNOWLEDGMENT

We thank Drs. William L. Robinson and Philip A. Doepke for their review of the manuscript. Thanks are extended to Duane King, Richard Berg, Kenneth Raisanen, and Mark McCune for their assistance in field work. The work was supported by a Department of Agriculture Research Agreement from the North Central Forest Experiment Station, St. Paul, Minnesota, to Dr. J. Kirwin Werner.

CONTENTS

	Page
Methods	1
Results	3
Discussion	8
Literature Cited	10

A SURVEY OF FISHES OF THE McCORMICK FOREST

Ronald A. Raisanen, *Graduate Student*
and
J. Kirwin Werner, *Associate Professor of Biology*
Northern Michigan University, Marquette, Michigan

The fish population in the Cyrus H. McCormick Experimental Forest has long intrigued the public. Rumors of lunker bass and trout, the wilderness character of the forest itself, and articles such as Jerry Chiappeta's in *Field and Stream* magazine (May 1970) have done much to sustain this interest. Although the forest is blessed with a pristine character and fish transplants have occurred in the past, a recent survey indicates there is no outstanding fishing for top game species, at least in comparison to surrounding areas. In general, the lakes and streams of the McCormick Forest are bog-like in character, low in productivity, and support only small populations of game fish.

In 1972, the North Central Forest Experiment Station, U. S. Department of Agriculture, Forest Service began investigating the vertebrate fauna of the McCormick Forest. Birds, mammals, amphibians, and reptiles were the subjects of publications by Robinson (1973, 1975) and Werner (1973, 1975). This report describes the fish species present, their distribution, and relative abundance among the four drainage systems within the forest.

METHODS

Canoes and a lightweight john boat were used on most lakes. An 18-foot electrofishing boat or boom shocker was used in sampling White Deer, Bulldog, and Lower Baraga Lakes. Minnow traps were set in the shallows of larger lakes, in ponds, and in all streams. Fyke nets were used in all of the lakes sampled. They were set perpendicular to the shore in water deep enough to cover the net (1.5 to 3.0 m). Gill nets were used in all lakes except Groves Lake; they were set perpendicular to the shore in water ranging from 0.6 m deep at the shore end to 6 m on the lakeward end. Offshore sets were also made in the deeper sections of the larger lakes.

A backpack electrofishing unit was used effectively in rivers and small streams even though the conductivity of the water was generally low. Fishing with plugs and casting equipment, i.e., the hook and line method, was also used to indicate the presence of large predatory species.

Specimens were killed in the field with 10 percent formalin and later transferred to jars with fresh 10 percent formalin in the laboratory. The quality of specimens was very good if the specimens were killed immediately and remained in the killing solution for at least 0.5 hours or longer. Specimens were identified using the taxonomic keys in Hubbs and Lagler (1958), Scott and Crossman (1973), and Trautmen (1957).

A detailed analysis of the man-hours expended for each collecting method and for each location as well as a physical description of the lakes and streams can be found in Raisanen (1976).

Field work extended from May to October, 1975. Sampling of the McCormick Forest was done according to the four drainage systems (fig. 1). The Peshekee River drains the western sections of the forest and flows into Lake Michigamme to the south and eventually into Lake Michigan. The Yellow Dog River drains the northeast and central portions of the forest and flows into Lake Independence which flows into Lake Superior via the Iron River. The Huron and Dead Rivers drain the northwestern and southeastern portions of the tract, respectively, and flow directly into Lake Superior.

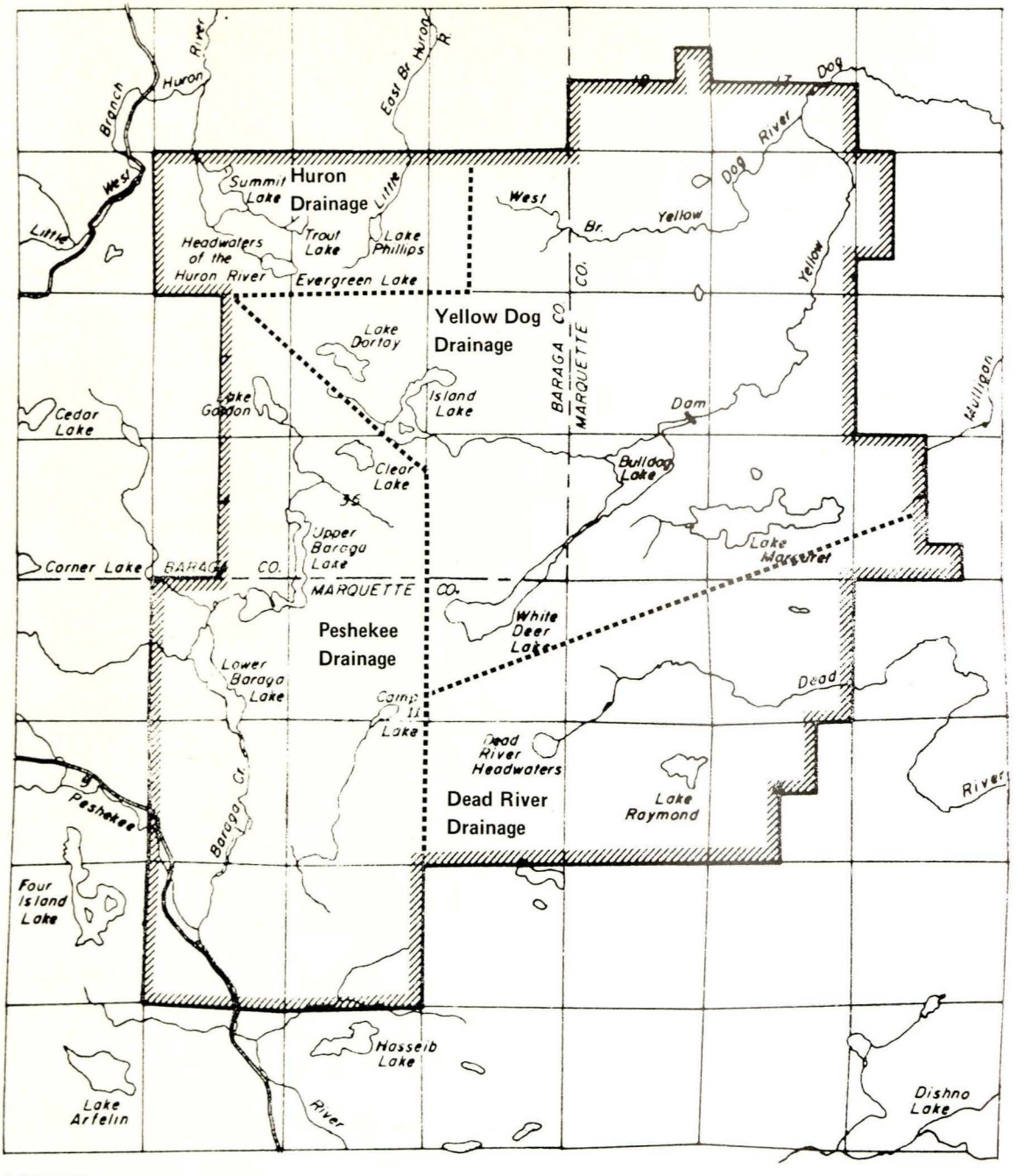


Figure 1. — *Four drainages on the Cyrus M. McCormick Experimental Forest.*

RESULTS

About 2,500 fish were taken in 60 collections throughout the study (Raisanen 1976). More than 1,600 of these were preserved for the Northern Michigan University Museum of Zoology. The remainder were released. Altogether, 29 species from 10 families and 21 genera were represented (tables 1-4). Following is a brief account of the species collected including observations on reproduction and distribution.

Catostomidae — The Sucker Family

Longnose sucker (Catostomus catostomus)

Lowe collected the longnose sucker only from lakes in the Lake Superior drainage (Taylor 1954) and Hubbs and Lagler (1958) considered the longnose sucker as occurring inland only in lakes draining to Lake Superior. The single male specimen we collected was in post-breeding condition and taken in mid-June from Clear Lake in the Peshekee drainage, which is part of the Lake Michigan watershed.

White sucker (Catostomus commersoni)

The white sucker is a very common and uniformly distributed species in the Upper Peninsula (Taylor 1954). This sucker was taken often in the Peshekee and Huron drainages but not in the Dead River or Yellow Dog River drainages. The greatest number was collected from Lake Gordon and Clear Lake when these lakes were sampled in mid-June and suckers were spawning. Lack of suitable spawning habitat could account for the white sucker's absence in all of the lakes of the Yellow Dog drainage and Lake Raymond in the Dead River drainage.

Table 1. — *Species found in the Peshekee River drainage system*

Species	Gordon Lake	Clear Lake plus the Clear Lake outlet	Upper Baraga Lake inlet	Upper Baraga Lake	Lower Baraga Lake	Peshekee River	Camp 11 Lake outlet	Unnamed creek T49N R30W Sec. 2	Relative Abundance[1]
Longnose sucker		X							R
White sucker	X	X			X	X			A
Rock bass				X	X				C
Green sunfish	X								C
Pumpkinseed	X								C
Smallmouth bass					X	X			R
Largemouth bass			X	X	X				C
Mottled sculpin			X			X	X		C
Golden shiner					X				C
Common shiner					X	X			R
N. Redbelly dace		X						X	A
Finescale dace								X	A
Bluntnose minnow		X				X			R
Fathead minnow		X							C
Blacknose dace						X	X		A
Creek chub	X	X	X			X	X		A
Northern pike					X	X			A
Burbot				X		X	X		R
Brook stickleback								X	C
Iowa darter		X							R
Yellow perch	X	X		X	X				A
Logperch						X			C
Brown trout						X			R
Brook trout			X						R
Mudminnow						X			R

[1]A--Abundant (easily collected in large numbers); C--Common (collected often but not in great numbers); R--Rare (seldom collected).

Table 2. — *Species found in the Yellow Dog River drainage system*

Species	Bulldog and White Deer Lake	Margaret Lake	Island Lake	Island Lake outlet	Dortay Lake	West Branch Yellow Dog River below falls	West Branch Yellow Dog River above falls	East Branch Yellow Dog River below falls	Groves Lake	Relative Abundance[1]
White sucker								X		C
Largemouth bass	X		X							C
Mottled sculpin	X		X	X						C
Golden shiner	X	X	X	X						A
Blacknose shiner	X				X					C
N. Redbelly dace	X	X	X	X	X					A
Finescale dace	X	X		X	X					A
Bluntnose minnow	X		X							C
Fathead minnow		X							X	A
Blacknose dace						X				A
Lognose dace						X				R
Creek chub	X			X				X		A
Pearl dace	X	X		X						A
Brook stickleback	X		X	X					X	C
Iowa darter	X	X	X		X					A
Yellow perch	X	X	X	X	X					A
Brook trout						X	X	X		C

[1]A--Abundant; C--Common; R--Rare.

Table 3. — *Species found in the Huron River drainage system*

Species	Summit Lake	Trout Lake	Evergreen Lake	Summit Lake outlet	Little West Branch of the Huron River	Relative Abundance[1]
White sucker	X	X				A
Blacknose shiner			X			R
N. Redbelly dace			X			A
Blacknose dace	X			X	X	C
Creek chub	X			X	X	A
Pearl dace	X	X	X			A
Brook stickleback			X			C
Iowa darter			X	X		R
Yellow perch	X	X				C
Brook trout					X	R

[1]A--Abundant; C--Common; R--Rare.

Table 4. — *Species found in the Dead River drainage system*

Species	Round Lake	Lake Raymond	Dead River	Relative Abundance[1]
Brassy minnow	X			R
Blacknose shiner	X			R
N. Redbelly dace	X	X	X	A
Finescale dace	X			A
Fathead minnow	X			A
Creek chub			X	C
Pearl dace	X	X		A
Brook stickleback	X		X	C
Iowa darter	X			C

[1]A--Abundant; C--Common; R--Rare.

Centrarchidae — The Sunfish Family

Rock bass — (Amblophlites rupestris)

Most of the rock bass caught were small, less than 15 cm total length, and taken with minnow traps.

Several centrarchid nests, presumably made by rock bass, were observed in shallow water (1 m deep) near the Lower Baraga Lake outlet in mid-July. The restriction of rock bass to Upper and Lower Baraga Lakes could be due to the species' avoidance of small streams with moderate to rapidly flowing water, such as the drainages from Clear Lake and Lake Gordon. The absence of rock bass in the other drainage systems in the forest is probably due to physical barriers, falls, rapids, or beaver dams, that extend downstream from the forest boundaries.

Green sunfish (Lepomis cyanellus)

Hubbs and Lagler (1958) considered green sunfish rare in the Upper Peninsula and Lowe collected it from only a few scattered locations including Marquette County. Green sunfish were found exclusively in Lake Gordon of the Peshekee drainage where they were readily caught along with pumpkinseed sunfish in fyke nets set in water 1 to 2 m deep. Many spawning nests possibly made by green sunfish were observed in water about 1 m deep near the shore at the southeast end of the lake. The nests were small, about 0.3 m in diameter, but it could not be determined if they were made by green sunfish or by pumpkinseeds.

Pumpkinseed (Lepomis gibbosus)

The pumpkinseed sunfish is considered native to Michigan and is present in all counties of the Upper Peninsula (Taylor 1954). In the McCormick Forest, pumpkinseed were found only in Lake Gordon but again were readily caught along with green sunfish in fyke nets set in water 1 to 2 m deep. The absence of pumpkinseed in the rest of the McCormick Forest is probably due to the same physical and ecological barriers that have prevented further movement of the green sunfish and rock bass. The spawning nests mentioned in the account of the green sunfish could have been excavated by pumpkinseeds, which spawn at the same time and in a similar manner.

Smallmouth bass (Micropterus dolomieui)

Smallmouth bass are native to the Great Lakes region and have also been planted extensively over the Upper Peninsula (Taylor 1954). One adult smallmouth bass, 48 cm long, and two young of the year were taken from Lower Baraga Lake in late July. Smallmouth bass were not found in the other drainage systems.

Largemouth bass (Micropterus salmoides)

The largemouth bass has been extensively introduced by man and can now be found in all counties of the Upper Peninsula (Taylor 1954). In the McCormick Forest, largemouth bass were planted in White Deer Lake and Island Lake in the Yellow Dog drainage. In addition, largemouth bass were found in several lakes of the Peshekee drainage including Clear Lake, where they were observed to spawn during the month of June. Largemouth bass were not found in the Huron or Dead River drainages.

Cottidae — The Sculpin Family

Mottled sculpin (Cottus bairdi)

Mottled sculpins prefer cool streams but do well in any cool water with a rocky bottom. There is suitable habitat in each drainage system for the mottled sculpin but none were found in the Huron River or Dead River drainages. Low susceptibility to nets and traps could account for their apparent absence from the latter two drainages. Mottled sculpins are often found with brook trout and both species were collected from the Upper Baraga Lake Inlet.

Cyprinidae — The Minnow Family

Brassy minnow (Hybognathus hankinsoni)

Brassy minnows were found only in Round Lake in the Dead River drainage.

Golden shiner (Notemigonus crysoleucas)

More golden shiners were caught in White Deer Lake than any other species from a single location. Golden shiners prefer clear, weedy, quiet waters with extensive shallow areas (Scott and Crossman 1973), which probably accounts for their abundance in the Yellow Dog drainage, particularly White Deer Lake.

Common shiner (Notropis cornutus)

Common shiners were one of the few species taken exclusively by electrofishing gear. Adults were found in Baraga Lake and young-of-the-year in the Peshekee River in August.

Blacknose shiner (Notropis heterolepis)

Blacknose shiners are declining or have been eliminated from parts of their range because of an intolerance towards turbidity (Scott and Crossman 1973). The presence of this species in three of the four drainages of the McCormick Forest is probably a good indicator of the present condition of the water and the forest's history of minimal exploitation by man.

Northern redbelly dace (Phoxinus eos)

Northern redbelly dace prefer small quiet bog waters with detritus or silt bottoms (Scott and Crossman 1973). This type of habitat abounds in the McCormick Forest and it is not surprising that the species was one of four found in all four drainage systems. Only one other species, the creek chub, was found in more locations. Female redbelly dace collected from the unnamed creek in Section 2 (fig. 1) in May contained small, underdeveloped eggs, but those collected from the Island Lake drainage in mid-June and from Groves Lake in mid-August were full of mature eggs.

Finescale dace (Phoxinus neogaeus)

This species was always associated with the northern redbelly dace but was not as widely distributed. The finescale and northern redbelly dace often produce fertile hybrids that are intermediate between both species in pigmentation and size of mouth (Taylor 1954). Several specimens collected from Lake Dortay appeared to be hybrids.

Bluntnose minnow (Pimephales notatus)

Male bluntnose minnows collected from White Deer Lake and Island Lake in July were in breeding condition as evidenced by well developed breeding tubercles on the snout.

Fathead minnow (Pimephales promelas)

Male fathead minnows collected from Groves Lake and Lake Margaret in July had well developed spongy pads on the dorsum from behind the head to the base of the dorsal fin, indicating full breeding condition. Specimens from Clear Lake on the Peshekee drainage and Groves Lake in the Yellow Dog drainage were smaller than those collected from Lake Margaret. Mature males collected from Clear Lake and Groves Lake were 45 to 60 mm long while those from Lake Margaret were 75 to 90 mm long. Specimens from Lake Margaret had a lateral line that was almost complete while those from Clear and Groves Lakes had a lateral line that ended below the dorsal fin. Fathead minnows were very common in Lake Margaret but were not found in White Deer Lake or Bulldog Lake. The latter receives water from Lake Margaret by a short (quarter mile) stream.

Blacknose dace (Rhinichthys atratulus)

The blacknose dace prefers small, swiftly flowing, clear streams (Scott and Crossman 1973) and was encountered in such habitat in the Yellow Dog, Peshekee, and Huron drainages. The falls on the east and west branches of the Yellow Dog seem to block upstream movement, because habitat types are similar above and below the falls yet blacknose dace were found only below the falls.

Longnose dace (Rhinichthys cataractae)

The longnose and blacknose dace, which occupy similar habitat, apparently do not produce hybrids in the wild due to differences in spawning habits (Howell and Villa 1976). In the McCormick Forest, the two species coexist in the Yellow Dog River below the falls with no apparent hybridization.

Creek chub (Semotilus atromaculatus)

Scott and Crossman (1973) considered the creek chub to be one of the most common stream minnows in eastern North America and this proved to be true in the McCormick Forest. The creek chub was found in all drainages and was collected in more locations than any other fish. This species is often associated with the common shiner, and

hybridization occurs where the two coexist. Sympatric populations were found in the Peshekee drainage but there did not appear to be hybridization.

Pearl dace (Semotilus margarita)

The pearl dace is usually found in bogs, lakes, and ponds, typical habitat in the McCormick Forest. Associated with the pearl dace were other bog species including the redbelly dace, finescale dace, brook stickleback, and the fathead minnow. In Michigan pearl dace spawn in clear water 24 to 60 cm deep on sand or gravel bottoms in weak or moderate currents (Scott and Crossman 1973). From our observations, pearl dace may also be spawning in lakes, i.e., Lake Raymond and Evergreen Lake, because, both lakes had large populations of pearl dace but did not have inlets or outlets that were suitable for spawning (seepage only).

Esocidae — The Pike Family

Northern pike (Esox lucius)

The northern pike was collected only from the Baraga Lakes of the Peshekee drainage. It is known to occur in lower regions of the Dead and Yellow Dog drainages outside of the McCormick Forest and thus is probably inhibited from upstream movement by physical barriers such as small, fast-moving streams.

Gadidae — The Cod Family

Burbot (Lota lota)

Three specimens of *Lota lota,* 15 to 30 cm long, were collected from the Peshekee drainage. Burbot are difficult to collect with passive gear except when spawning (under the ice) and were probably missed in some collections.

Gasterosteidae — The Stickleback Family

Brook stickleback (Culaea inconstans)

Brook stickleback were distributed throughout the four drainage systems in clear, cool streams, spring-fed pools, or clear margins of bog lakes. Many were found in association with fathead minnows, northern redbelly dace, finescale, and pearl dace.

Percidae — The Perch Family

Iowa darter (Etheostoma exile)

The Iowa darter was found commonly in clear lakes or slowly moving streams with rooted aquatic vegetation in all four drainage systems.

Yellow perch (Perca flavescens)

Yellow perch were common in all but the Dead River drainage, but are known to be common in the other drainages outside the McCormick Forest.

Logperch (Percina caprodes)

The logperch is widely distributed in eastern North America as well as the Upper Peninsula, but was found only in the Peshekee River.

Salmonidae — The Trout Family

Brown trout (Salmo trutta)

In 1954, Taylor considered the distribution of the brown trout in the Upper Peninsula spotty, but today it is found in many locations throughout the Upper Peninsula and the Great Lakes Region. The occurrence of the brown trout in the Peshekee River is the result of periodic stocking by the Michigan Department of Natural Resources.

Brook trout (Salvelinus fontinalis)

Brook trout were found in the Yellow Dog River and in the connecting waters between Upper Baraga Lake and Lake Gordon. They were reported to occur in the Camp 11 Lake drainage[1] but none were collected in the lower sections of that stream. Apparently attempts made to introduce brook trout into Lake Margaret and Summit Lake were not successful.

Umbridae — The Mudminnow Family

Central mudminnow (Umbra limi)

The single mudminnow specimen collected from the Peshekee drainage is probably not indicative of the range of this species in the McCormick Forest. Suitable habitat is available for the mudminnow in all four drainages but its secretive nature and mud-dwelling existence make it difficult to collect.

DISCUSSION

The bedrock in the McCormick Forest is composed mostly of granite, gneiss, and slate — rocks poor in dissolvable nutrients. The glacial drift tends to be acidic (Forest Service soils report on file at the U. S. Forest Service office in Kenton, Michigan) and the soils have been strongly influenced by poor drainage and a history of conifer forests. Consequently, the lakes formed in the McCormick Forest are acidic, soft, and unproductive. These properties and the dark stained brown water, which is caused by an accumulation of leached humic material from the soil, are characteristic of lakes in bog regions. Clear Lake is the only exception to this in the McCormick Forest, having relatively clear water and a gravel bottom.

The breakdown of organic matter (detritus) through decomposition or aerobic metabolism can decrease or, in extreme situations, totally deplete dissolved oxygen in the water. This can occur at any time of the year in small shallow bog pools but is most likely during the winter when atmospheric oxygen and sunlight are unable to reach the water due to a covering of ice and snow. The following lakes in the McCormick Forest have accumulated so much detritus that winterkill is likely during severe winters with heavy accumulations of snow: Round, Groves, Camp 11, Dortay, Evergreen, Phillips, and possibly White Deer Lake. The remainder of the lakes in the forest have predominantly rock, gravel, and sand bottoms with little detritus.

All of the lakes in the McCormick Forest are shallow. The maximum depth recorded by Campbell (1969) was 7.9 m in Lake Margaret. The soundings and observations made during this study indicate that it is unlikely any of the lakes in the McCormick Forest are deeper than 9.1 m and most are less than 7.6 m deep. Shallow water lakes do not stratify during the summer and are prone to winterkill like those lakes with heavy detritus accumulations.

Drainage Comparisons

Peshekee drainage

Of the four drainages in the McCormick Forest, the Peshekee drainage had the greatest variety of fish: 10 families, 20 genera, and 25 species (table 1). Three of the families, the pike, the cod, and the mudminnows were not only exclusive to the Peshekee drainage but were represented by only one species each, the northern pike, burbot, and the central mudminnow, respectively. Rock bass, green sunfish, pumpkinseed, smallmouth bass, longnose sucker, brown trout, common shiner, and the log-perch were also found exclusively in the Peshekee drainage. Only four species, the brassy minnow, blacknose shiner, longnose dace, and pearl dace, all from the minnow family, were not found in the Peshekee drainage. The abundance of species in the Peshekee drainage is undoubtedly due to the size of the river and its southerly connections via Lake Michigamme and the Menominee River to Lake Michigan. Present species distribution has also been affected by past Great Lakes drainage via the Mississippi River, which afforded entry to the Great Lakes from the Northwest and the upper Mississippi Valley (Hubbs and Lagler 1958, Darlington 1957). Species such as the northern pike, burbot,

[1]*Personal communication with Kenneth Nowell, former manager of the McCormick Forest.*

white sucker, smallmouth bass, rock bass, pumpkinseed, and some of the minnows that utilize or tolerate large rivers, probably entered the McCormick Forest via the present river. The remaining species in the Peshekee drainage, including many of the minnows, the Iowa darter, yellow perch, and perhaps some of those already mentioned, could have followed the retreating glaciers, establishing themselves via presently nonexistent streams (Darlington 1957). The species introduced by man, the brown trout, perhaps the green sunfish, and possibly the largemouth bass, could have established themselves in the Peshekee drainage after being introduced in some part of the Michigamme River or Menominee River drainages.

Yellow Dog drainage

The Yellow Dog drainage had the second greatest number of species and families in the McCormick Forest (17 species from 7 families). However, there were no families exclusive to the Yellow Dog drainage and only one exclusive species, the longnose dace. More cyprinids, both in numbers and species diversity, were collected from the Yellow Dog drainage than from any other drainage. This is most likely due to the lack of predatory fish and/or competition from such species as the sunfish or suckers, plus a variety of favorable habitat. Until recently, when the largemouth bass was introduced into White Deer Lake and Island Lake, the only piscivorous species were the yellow perch and large creek chubs. Golden shiners, fathead minnows, and yellow perch were most numerous while the redbelly dace was most widely distributed.

Underhill (1957) listed specific minnows and darters that were considered as early arrivers after the recession of the glaciers. All of the minnows and the Iowa darter collected in the Yellow Dog drainage (table 2) are included in that list. Species now established in the Yellow Dog drainage apparently did so during or shortly after glacier recession and before the falls on the East and West Branches of the Yellow Dog River became important physical barriers to upstream movement.

The centrarchids, except for the largemouth bass which was introduced, are notable for their absence from the lakes of the Yellow Dog drainage. Apparently ecological barriers (probably stream habitat) of physical impediments (falls or rapids) prevented sunfish from reaching the McCormick Forest.

Huron drainage

Ten species representing 9 genera and 5 families were collected in the Huron River drainage. Brook trout collected outside the McCormick Forest in the Little West Branch of the Huron River about 0.8 km west of Summit Lake are included in the list (table 3). The cyprinids were the most common family in the drainage with five species. Pearl dace and creek chubs were the most numerous and widely distributed fish species. The absence of the yellow perch and the white sucker from Evergreen Lake could be due to the inability of these species to ascend the small intermittently flowing stream between Evergreen Lake and the Little East Branch of the Huron River or lack of suitable spawning habitat.

Dead River drainage

Nine species representing 7 genera and 3 families were collected in the Dead River drainage. The greatest number of fish belong to the minnow family (table 4) as in the Yellow Dog and Huron River drainages. The brook stickleback and the Iowa darter were the only species collected in the Dead River drainage that were not cyprinids. Round Lake and Lake Raymond, the only two lakes in the Dead River drainage, have intermittently flowing connections with the Dead River. Apparently the outlet from Lake Raymond has never been well developed and/or downstream barriers have prevented common species such as the yellow perch from becoming established in the lake. Round Lake is well suited for species, such as the brassy minnow and northern redbelly dace, that prefer small shallow bog ponds or pools.

Species possibly present in the McCormick Forest

The following species collected by Lowe in Marquette and/or Baraga Counties may be present in the McCormick Forest but were not collected: the walleye *(Stizostedion vitreum),* brown bullhead *(Ictalurus nebulosus),* bluegill *(Lepomis*

macrochirus), black bullhead *(Ictalurus melas),* rainbow trout *(Salmo gairdneri),* mimic shiner *(Notropis volucellus),* blackchin shiner *(Notropis heterodon),* and the johny darter *(Etheostoma nigrum).* All of the above are native to the Upper Peninsula except for the rainbow trout, which has been widely introduced and has been planted in the Peshekee River by the Michigan Department of Natural Resources (DNR fish planting report). The walleye and the bullheads were collected by Lowe in the Michigamme and could easily become established in the McCormick Forest via the Peshekee River. The black bullhead was collected from Crooked Lake and the brown bullhead from the Beaufort River (Spurr River on some maps), 8.5 and 12.5 km, respectively, southwest of the McCormick Forest. However, bullheads prefer slow-moving, warm water with soft bottoms and are unlikely to reach the McCormick Forest in the near future if they are not already there. The mimic shiner and the johnny darter were collected from Lake Independence by Lowe; however, physical barriers have probably kept these fish from reaching the McCormick Forest. The blackchin shiner is not a common species in the Upper Peninsula, but it was collected often in the Menominee River drainage in Menominee County by Lowe. It is doubtful that this species has moved upstream as far as the McCormick Forest. Several species of lamprey *(Petromyzontidae)* were also collected by Lowe and could occur in the McCormick Forest.

LITERATURE CITED

Darlington, Philip J., Jr. 1957. Zoogeography. 675 p. John Wiley & Sons, Inc., New York.

Howell, W. M., and J. Villa. 1976. Chromosomal homogeneity in two sympatric cyprinid fishes of the genus *Rhinichthys.* Copeia 1976(1): 112-116.

Hubbs, Carl L., and Karl F. Lagler. 1958. Fishes of the Great Lakes Region. 2nd ed., 3rd reprint 1970. 213 p. Univ. Michigan Press, Ann Arbor.

Raisanen, Ronald A. 1976. A survey of the fishes of the McCormick Forest. M. A. Thesis. Northern Michigan University, Marquette, Michigan. 98 p.

Robinson, W. L. 1973. McCormick Forest Wildlife: here today and here tomorrow? Naturalist 24(1):12-20.

Robinson, W. L. 1975. Vertebrate animal populations of the McCormick Forest. I. Birds and Mammals. USDA For. Serv. Res. Pap. NC-118, 25 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Res. Board of Canada, Ottawa Bull. 184, 966 p.

Taylor, William Ralph. 1954. Records of fishes in the John N. Lowe collection from the Upper Peninsula of Michigan. Misc. Pub., Mus. Zool. Univ. Michigan 87:1-50.

Trautmen, Milton B. 1957. The fishes of Ohio. 683 p. The Ohio State Univ. Press, Waverly Press, Inc., Baltimore.

Underhill, J. C. 1957. The distribution of Minnesota minnows and darters. Occas. Pap. 7, 41 p. Minnesota Mus. Natur. Hist.

Werner, J. Kirwin. 1973. The reptiles and amphibians of the McCormick Forest. Naturalist 24(1):21-27.

Werner, J. Kirwin. 1975. Vertebrate animal populations of the McCormick Forest. II. Amphibians and reptiles. USDA For. Serv. Res. Pap. NC-118, 25 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

☆U.S. GOVERNMENT PRINTING OFFICE: 1977—767-588/45

Raisanen, Ronald A., and J. Kirwin Werner.
1977. A survey of fishes of the McCormick Forest. USDA For. Serv. Res. Pap. NC-147, 10 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

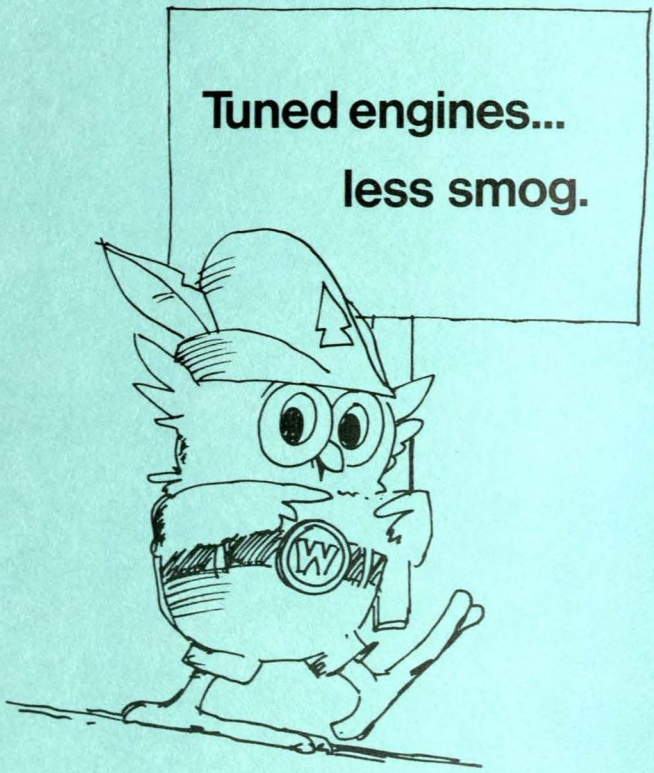
The four drainage systems of the Cyrus H. McCormick Experimental Forest were surveyed from May through October, 1975 to determine the distribution and relative abundance of fish. More than 2,500 fish were collected. Game species, such as brook trout *(Salvelinus fontinalis),* largemouth bass *(Micropterus salmoides),* smallmouth bass *(Micropterus dolomieui),* and northern pike *(Esox lucius),* were present but not in large numbers.

OXFORD: 147(774). KEY WORDS: Upper Peninsula, trout, bass, pike, game fish, fish species.

Raisanen, Ronald A., and J. Kirwin Werner.
1977. A survey of fishes of the McCormick Forest. USDA For. Serv. Res. Pap. NC-147, 10 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

The four drainage systems of the Cyrus H. McCormick Experimental Forest were surveyed from May through October, 1975 to determine the distribution and relative abundance of fish. More than 2,500 fish were collected. Game species, such as brook trout *(Salvelinus fontinalis),* largemouth bass *(Micropterus salmoides),* smallmouth bass *(Micropterus dolomieui),* and northern pike *(Esox lucius),* were present but not in large numbers.

OXFORD: 147(774). KEY WORDS: Upper Peninsula, trout, bass, pike, game fish, fish species.


Tuned engines...
less smog.